

Testing and analytical modeling for purging process of a cryogenic line

A. Hedayat¹, P. V. Mazurkivich¹, M. A. Nelson¹, and A. K. Majumdar²

¹*Propulsion Systems Dep./ER22, Marshall Space Flight Center, Huntsville, AL 35812 U.S.A.*

²*Propulsion Systems Dep./ER43, Marshall Space Flight Center, Huntsville, AL 35812 U.S.A.*

The purging operations for cryogenic main propulsion systems of upper stage are usually carried out for the following cases: 1) Purging of the Fill/Drain line after completion of propellant loading. This operation allows the removal of residual propellant mass; and 2) Purging of the Feed/Drain line if the mission is scrubbed. The lines would be purged by connections to a ground high-pressure gas storage source. The flowrate of purge gas should be regulated such that the pressure in the line will not exceed the required maximum allowable value. Exceeding the maximum allowable pressure may lead to structural damage in the line. To gain confidence in analytical models of the purge process, a test series was conducted. The test article, a 20-cm incline line, was filled with liquid hydrogen and then purged with gaseous helium (GHe). The influences of GHe flowrates and initial temperatures were evaluated. The Generalized Fluid System Simulation Program, an in-house general-purpose computer program for flow network analysis, was utilized to model and simulate the testing. The test procedures, modeling descriptions, and the results will be presented in the final paper.